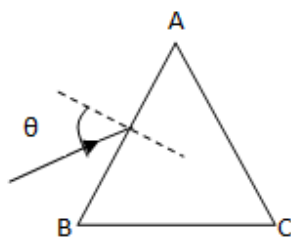




24. Monochromatic light is incident on a glass prism of angle  $A$ . If the refractive index of the material of the prism is  $\mu$ , a ray, incident at an angle  $\theta$ , on the face  $AB$  would get transmitted through the face  $AC$  of the prism provided:



- (1)  $\theta > \sin^{-1} \left[ \mu \sin \left( A - \sin^{-1} \left( \frac{1}{\mu} \right) \right) \right]$     (2)  $\theta < \sin^{-1} \left[ \mu \sin \left( A - \sin^{-1} \left( \frac{1}{\mu} \right) \right) \right]$   
 (3)  $\theta > \cos^{-1} \left[ \mu \sin \left( A + \sin^{-1} \left( \frac{1}{\mu} \right) \right) \right]$     (4)  $\theta < \cos^{-1} \left[ \mu \sin \left( A + \sin^{-1} \left( \frac{1}{\mu} \right) \right) \right]$

**Answer:** For transmission through the face  $AC$  light should incident on inner surface of  $AC$  less than the critical angle i.e.  $r_2 < \theta_c$ .

<p>From the figure in Quadrilateral AQOM</p> $A + \angle AQM + \angle QOR + \angle ORA = 360$ <p>or <math>A + 90 + \angle QOR + 90 = 360</math>          or <math>\angle QOR = 180 - A \rightarrow (1)</math>          in <math>\Delta QOR : r_1 + r_2 + \angle QOR = 180</math></p> <p>or <math>r_1 + r_2 + 180 - A = 180</math>          or <math>r_2 = A - r_1</math> but <math>r_2 &lt; \theta_c</math></p>	<p>or <math>A - r_1 &lt; \sin \theta_c</math> or <math>\sin(A - r_1) &lt; \left( \frac{1}{\mu} \right)</math>          or <math>A - r_1 &lt; \sin^{-1} \left( \frac{1}{\mu} \right)</math>          or <math>r_1 &gt; A - \sin^{-1} \left( \frac{1}{\mu} \right) \rightarrow (2)</math>          [ Note multiplied by negative sign reverse <math>&gt;</math> to <math>&lt;</math> ]          now <math>\mu = \frac{\sin \theta}{\sin r_1}</math> or <math>\sin r_1 = \frac{\sin \theta}{\mu}</math> putting in (2)          we get <math>\sin r_1 &gt; \sin \left\{ A - \sin^{-1} \left( \frac{1}{\mu} \right) \right\}</math>          or <math>\frac{\sin \theta}{\mu} &gt; \sin \left\{ A - \sin^{-1} \left( \frac{1}{\mu} \right) \right\}</math>          or <math>\sin \theta &gt; \mu \sin \left\{ A - \sin^{-1} \left( \frac{1}{\mu} \right) \right\}</math>          or <math>\theta &gt; \sin^{-1} \left[ \mu \sin \left\{ A - \sin^{-1} \left( \frac{1}{\mu} \right) \right\} \right]</math>  <b>Correct option is (1) <math>\theta &gt; \sin^{-1} \left[ \mu \sin \left\{ A - \sin^{-1} \left( \frac{1}{\mu} \right) \right\} \right]</math></b></p>
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